



Meniscus Repair Scientific Update

An increase in published orthopedic literature regarding meniscus function, pathology, and repair is leading to increased understanding of the importance of meniscal preservation. The meniscus is a fibrocartilaginous structure in each compartment of the knee that aids with dispersing compressive forces. Multiple pathologies, such as direct trauma, overuse, previous injury, and increased age, can lead to meniscus damage.

Advancements in technology and innovation have produced better techniques and instrumentation for meniscus repair. This document summarizes published studies that describe the meniscus anatomy, biomechanical data, surgical techniques, and clinical data.

Toman CV,
Dunn WR,
Spindler KP,
et al

Meniscus Repair

[Success of meniscal repair at anterior cruciate ligament reconstruction.](#) *Am J Sports Med.* 2009;37(6):1111-1115. doi:10.1177/0363546509337010.

- MOON (Multicenter Orthopaedic Outcomes Network) case study examining meniscal repair with ACL reconstruction success at 2-year follow-up
- There is an estimated 90% clinical success rate of meniscal repair at 2-year follow up when meniscus is repaired at the time of an ACL reconstruction
- “Meniscal repair is a successful procedure in conjunction with anterior cruciate ligament reconstruction”

Phillips M,
Rönnblad E,
Lopez-Rengstig L,
et al

[Meniscus repair with simultaneous ACL reconstruction demonstrated similar clinical outcomes as isolated ACL repair: a result not seen with meniscus resection.](#) *Knee Surg Sports Traumatol Arthrosc.* 2018;26:2270-2277. doi:10.1007/s00167-018-4862-1.

- A retrospective study comparing knee injury and osteoarthritis outcome score and EuroQol-5D subscale scores at 2-year follow-up for patients who had an ACL reconstruction and simultaneous meniscal treatment
- ACL reconstruction with meniscus resection resulted in worse clinical outcomes when compared to ACL reconstruction with meniscus repair
- Meniscus repair may provide greater clinical outcomes compared to meniscus resection when treating a repairable meniscal tear that presents along with an ACL tear

Cinque ME,
DePhillipo NN,
Moatshe G,
et al

[Clinical outcomes of inside-out meniscal repair according to anatomic zone of the meniscal tear.](#) *Orthop J Sports Med.* 2019;7(7):2325967119860806. doi:10.1177/2325967119860806.

- Patient-reported outcomes improved significantly at a minimum of 2 years after inside-out meniscal repair, regardless of the vascular zone of the meniscal tear
- “Inside-out repair is recommended attempted for potentially repairable meniscal tears in all 3 vascular zones”

Beamer BS,
Kempland WC,
Okajima S,
Manoukian OS,
Perez-Viloria M,
DeAngelis JP,
Ramappa AJ,
Nazarian A

[Changes in contact area in meniscus horizontal cleavage tears subjected to repair and resection.](#) *Arthroscopy*. 2016;33(3):617-624. doi:10.1016/j.arthro.2016.03.004.

- Compared tibiofemoral contact pressure and contact area with a horizontal cleavage tear versus meniscal repair, partial meniscectomy, and subtotal meniscectomy
- Horizontal cleavage tears increased contact pressure 70%
- Circumferential suture repair restored peak contact pressures and areas to within 15% of baseline
- Partial and subtotal meniscectomy significantly reduced contact area and increased contact pressure

Kurzweil PR,
Lynch NM,
Coleman S,
Kearney B

[Repair of horizontal meniscus tears: a systematic review.](#) *Arthroscopy*. 2014;30(11):1513-1519. doi:10.1016/j.arthro.2015.05.038.

- Review of published outcomes of repaired horizontal cleavage tears and test of hypothesis that surgically repaired HCTs have an unacceptably low rate of success
- Nine previously published articles totaling 98 repairs of horizontal tears met inclusion criteria
- Seventy-six percent success rate for horizontal repairs disproving hypothesis and supporting repair of HCTs
- Sixty-eight percent success rate for vertical tears
- Eighty-four percent success rate for bucket-handle tears

Moatshe G,
Cinque ME,
Godin JA,
Vap AR,
Chahla J,
LaPrade RF

[Comparable outcomes after bucket-handle meniscal repair and vertical meniscal repair can be achieved at a minimum 2-year follow-up.](#) *Am J Sports Med*. 2017;45(13):3104-3110. doi:10.1177/0363546517719244.

- Comparison of outcomes following bucket-handle repairs and vertical meniscal repairs using a stacked vertical suturing technique
- Patients experience improved results and low failure rates with the repair of bucket-handle tears using a stacked vertical suture technique
- Improved results and low failure rates were achieved using the same surgical technique to address vertical meniscus tears

Steadman JR,
Matheny LM,
Singleton SB,
et al

[Meniscus suture repair: minimum 10-year outcomes in patients younger than 40 years compared with patients 40 and older.](#) *Am J Sports Med*. 2015;43(9):2222-2227. doi:10.1177/0363546515591260.

- Compared meniscus repair failure rates and functional outcomes between patients under 40 years of age and those who were older than 40 years at the time of the procedure
- Repair failure rate was not different between the 2 groups
- Lysholm, Tegner, and patient satisfaction scores were evaluated and indicated patients in both groups had high function and high patient satisfaction an average of 16 years following meniscus repair



Rothermel SD,
Smuin D,
Dhawan A

[Are outcomes after meniscal repair age dependent? A systematic review.](#) *Arthroscopy*. 2018;34(3):979-987. doi:10.1016/j.arthro.2017.08.287.

- Analysis of previously published data comparing patients younger than 40 years and older than 40 years undergoing meniscus repair
- Results reveal that no significant difference exists when evaluating failure rate for meniscus repair

Forkel P,
von Deimling C,
Lacheta L,
et al

Meniscus Root Repair

[Repair of the lateral posterior meniscal root improves stability in an ACL-deficient knee.](#) *Knee Surg Sports Traumatol Arthrosc*. 2018;26:2302-2309. doi:10.1007/s00167-018-4949-8.

- Cadaveric study to investigate the stabilizing effect of a meniscus root repair in an ACL- and root-deficient knee
- Root repair restored the function of the meniscus ring and reduced the internal tibial rotation
- Leaving these tears untreated might reduce postoperative knee stability after isolated ACL reconstruction

Faucett SC,
Geisler BP,
Chahla J,
Krych AJ,
Kurzweil PR,
Garner AM,
Liu S,
LaPrade R,
Pietzsch JB

[Meniscus root repair vs meniscectomy or nonoperative management to prevent knee osteoarthritis after medial meniscus root tears: clinical and economic effectiveness.](#) *Am J Sports Med*. 2019;47(3):762-769. doi:10.1177/0363546518755754.

- This study analyzed previously published data comparing meniscus repair, meniscectomy, and nonoperative treatment to osteoarthritis development, total knee replacement rates, and cost effectiveness
- Medial meniscus root repair led to fewer instances of osteoarthritis (53%) than meniscectomy (99.3%) and nonoperative treatment (95.1%) and fewer rates of total knee replacement (33.5%) compared to meniscectomy (51.5%) and nonoperative treatment (45.5%)
- Repair of medial meniscus root tears lead to less osteoarthritis and is a cost-saving intervention

Krych AJ,
Johnson NR,
Wu IT,
Smith PA,
Stuart MJ

[A simple cinch is superior to a locking loop for meniscus root repair: a human biomechanical comparison of suture constructs in a transtibial pull-out model.](#) *Knee Surg Sports Traumatol Arthrosc*. 2018;26(8):2239-2244. doi:10.1007/s00167-017-4652-1.

- Human cadaveric biomechanical study comparing simple cinch stitch to a locking loop stitch for meniscus root repair
- Simple cinch stitch had significantly less cyclic displacement and similar load to failure as compared to locking loop stitch
- Locking loop stitch requires multiple passes through meniscus tissue, which could lead to increased weakness of the meniscus

LaPrade CM,
LaPrade MD,
Turnbull TL,
Wijdicks CA,
LaPrade RF

[Biomechanical evaluation of the transtibial pullout technique for posterior medial meniscal root repairs using 1 and 2 transtibial bone tunnels.](#) *Am J Sports Med*. 2015;43(4):899-904. doi:10.1177/0363546514563278.

- Study proposes that 2 transtibial bone tunnels provide superior biomechanical advantages compared to a single transtibial bone tunnel
- Results showed that both techniques provided similar biomechanical properties



Chung KS,
Noh JM,
Ha JK,
Ra HJ,
Park SB,
Kim HK,
Kim JG

[Survivorship analysis and clinical outcomes of transtibial pullout repair for medial meniscus posterior root tears: a 5- to 10-year follow-up study.](#) *Arthroscopy*. 2018;34(2):530-535. doi:10.1016/j.arthro.2017.08.266.

- Ninety-one patients included with a mean follow-up duration of 7 years
- Lysholm scores improved significantly from 51.8 preoperatively to 83 at final follow-up
- Transtibial pullout repair demonstrated a high clinical survival rate and patients showed clinical improvements

Ramp Lesions

Mouton C,
Magosch A,
Pape D,
Hoffmann A,
Nuhrenborger C,
Seil R

[Ramp lesions of the medial meniscus are associated with a higher grade of dynamic rotatory laxity in ACL-injured patients in comparison to patients with an isolated injury.](#) [published online June 27, 2019]. *Knee Surg Sports Traumatol Arthrosc*. 2019. doi:10.1007/s00167-019-05579-z.

- Clinical evaluation to determine whether the presence of a ramp lesion of the medial meniscus in ACL injuries was associated with a higher grade of knee laxity
- Patients with a ramp lesion of the medial meniscus with an ACL injury displayed a higher amount of rotational laxity (grade III pivot shift) during the pivot shift test
- Findings suggest that the ramp of the medial meniscus acts as a secondary restraint in ACL-injured patients and it is critical to address and repair ramp lesions during ACL reconstruction

Chahla J,
Dean CS,
Moatshe G,
et al

[Meniscal ramp lesions: anatomy, incidence, diagnosis and treatment.](#) *Orthop J Sports Med*. 2016;4(7):2325967116657815. doi:10.1177/2325967116657815.

- Ramp lesions occur as a disruption of the meniscotibial ligaments of the posterior horn of the medial meniscus
- Injury is reported as being present in 9%-17% of ACL tears
- Ramp lesions do not always present on an MRI therefore arthroscopic evaluation is preferred

Thaunat M,
Jan N,
Fayard JM,
et al

[Repair of meniscal ramp lesions through a posteromedial portal during anterior cruciate ligament reconstruction: outcome study with a minimum 2-year follow-up.](#) *Arthroscopy*. 2016;32(11):2269-2277. doi:10.1016/j.arthro.2016.02.026.

- One hundred thirty-two patients met the inclusion criteria and the mean follow-up time was 27 months
- IKDC scores increased 21 points at last follow-up when compared to preoperative scores
- Results demonstrate arthroscopic repair of meniscal ramp lesions during ACL reconstruction provided a high rate of meniscus healing at the level of the tear



Kang HJ,
Chun CH,
Kim KM,
Cho HH,
Espinosa JC

Clinical Results of Suture Based Meniscus Repair

The results of all-inside meniscus repair using the Viper Repair System simultaneously with anterior cruciate ligament reconstruction. *Clinics in Orthopedic Surgery*. 2015;7:177-184. doi:10.4055/cios.2015.7.2.177.

- Nineteen patients were evaluated 12 to 24 months following all suture-based meniscus repair
- Follow-up evaluations were performed by a second look arthroscopy or magnetic resonance imaging (MRI)
- A success rate of 95.4% was reported with only one case showing failure due to re-rupture of the sutured area
- Conclusive results demonstrate suture repair using this system is an effective treatment for meniscus tears

Bogunovic L,
Kruse LH,
Haas AK,
Huston LJ,
Wright RW

Outcome of all-inside second-generation meniscal repair: minimum five-year follow-up. *J Bone Joint Surg Am*. 2014;96(15):1303-1307. doi:10.2016/JBJS.M.00266.

- Seventy-five patients were re-evaluated at a minimum of 5 years (average 7 years) following all-inside suture-based meniscus repair
- Meniscus repairs were standalone procedures or performed with concurrent ACL reconstruction
- Eighty-four percent of patients demonstrated successful meniscus repair
- All-inside meniscus repair demonstrates its effectiveness as an isolated procedure or when performed with an ACL reconstruction